

Meeting date: 13/14 January 2005**Open Govt. Status:** Fully Open**Type of paper:** For debates and development of a position**Paper File Ref:****Exemptions:**

WATCH COMMITTEE

Biological monitoring for isocyanates

Issue

1. Establishment of a biological monitoring guidance value (BMGV) for isocyanate metabolites in urine.

Timing Considerations

2. On 27 May 2004, the ACTS COSHH Essentials Working Group (CEWG) agreed that WATCH should appraise scientifically the evidence on biological monitoring for isocyanate exposure.

Recommendation

3. WATCH is invited to consider the issues noted in this paper and to respond to the actions in paragraph 12.

Background

4. Many isocyanates are classified in the Approved Supply List as respiratory sensitisers (R42). EH40 currently lists a MEL, accompanied by a SEN notation that applies to total isocyanate (monomer, prepolymer and reacting mixtures). With the anticipated introduction of the new OEL framework in April 2005, the existing MEL for isocyanates will become a Workplace Exposure Limit (WEL) of the same value. Under the requirements of the new system, as isocyanates have a SEN notation and R42 applies, exposure will be controlled to as low as is reasonably practical. Hence the same level of control will apply as now. Monitoring of airborne exposures to total isocyanate requires considerable expertise for analysis, is relatively costly, and cannot be used to assess the effectiveness of protection for workers wearing respiratory protective equipment (RPE).

5. Adequate control of exposure to isocyanate-based spray products normally requires the use of air-fed RPE.

Argument

6. The paper summarises the extensive literature of occupational and volunteer studies, relevant to biological monitoring. These show that biological monitoring by analysis of metabolites in urine is a relatively simple and inexpensive way to assess exposure to isocyanates, and a way to evaluate the effectiveness of control measures including RPE. It can also be used to evaluate secondary exposure (i.e. exposure of bystanders to the

specific process). End-of-shift urine samples are hydrolysed to release free isocyanate-derived diamines from protein conjugates in urine. After extraction and derivatisation, the samples are analysed by gas chromatography – mass spectrometry (GC-MS). The analytical methods are sufficiently sensitive to detect exposures well below the MEL, and for exposures of short duration. Volunteer studies of exposure to HDI, TDI and MDI have been conducted mainly with isocyanate monomers. Field studies have used the same methods for the determination of diamines to detect exposure to polymeric isocyanates. The quantitative relationship between exposure to polymeric isocyanates and urinary diamines concentration is not well understood, so the volunteer studies with monomeric isocyanate can only be used as a guide to total isocyanate exposures in the workplace.

7. HSE has studied exposure extensively to hexamethylene diisocyanate (HDI) in motor vehicle paint spraying. The results show that for good control practitioners, where exposure is well controlled, concentrations of hexamethylene diamine (HDA) are below the analytical detection limit. When exposure is not well controlled, HDA is found in urine. Similar, less extensive studies in other industries indicate that the relationship between good control practice and low urinary diamine concentrations remains true for diamines derived from toluene diisocyanate (TDI), methylenediphenyl diisocyanate (MDI) and isophorone diisocyanate (IPDI).

8. Presentations to conferences (eg BOHS 2004) and to various interested groups (eg the HSE Motor Vehicle Repair Forum) show that biological monitoring is an acceptable method of assessing control (both engineering and behavioural aspects). A sample costs around 5% of an air monitoring survey and gives direct information on personal exposure.

Link to HSC Strategy

9. This issue falls within the asthma sub-programme of the chemicals Disease Reduction Programme, specifically in relation to isocyanates-induced asthma.

Consultation

10. There has been no wider consultation on the content of this paper beyond HSE.

European Context

11. Isocyanates are currently under review by the EC DG EMP SCOEL committee.

Action

12. WATCH is invited:

- i. To recommend that biological monitoring is required to assess the effectiveness of control measures for isocyanate exposure.
- ii. To agree that a biological monitoring guidance value (BMGV) at 0.5 mol urinary diamines / mol creatinine released by hydrolysis of

protein conjugates of HDI, TDI, MDI or IPDI, is appropriate as a benchmark value.

This amount represents an equivalent monomeric isocyanate exposure below 5% of the current Maximum Exposure Limit and the future Workplace Exposure Limit (20 g/m³, 8-hour TWA).

- iii. To agree that where good control practice is followed, exposures can be reduced below 0.5 mol/mol to urinary diamine.

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References / Attachments

Annex 1 Biological monitoring of isocyanates